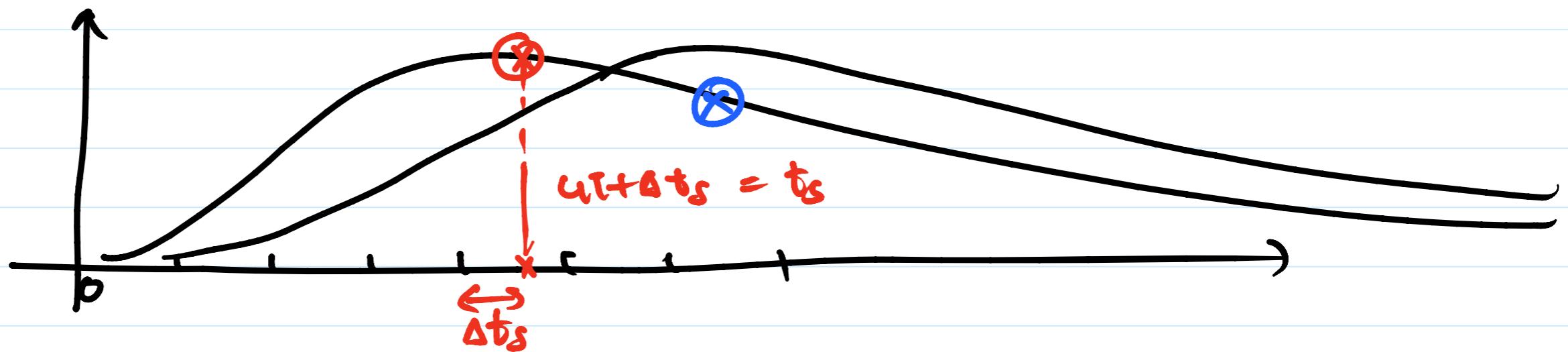


Steady-state solutions for equalizer coefficients.



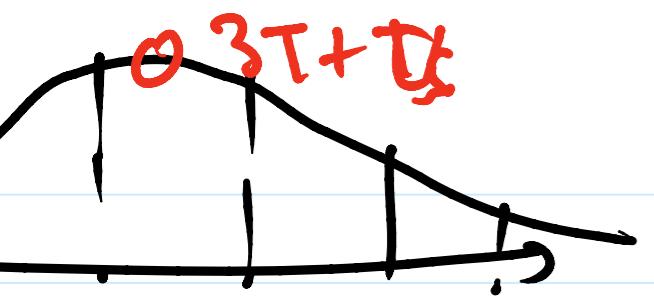
$$y[n] = d[n] \Phi(mT + t_s) + \sum_{k=0} \{ d_{n-1-k} (\Phi(mT + t_s + kT) - df_{k+1}) \quad (1)$$

$$y[n-\frac{T}{2}] = d[n] \Phi(mT + t_s - \frac{T}{2}) + \{ d[n-1] \Phi(mT + [kT + t_s + \frac{T}{2}]) - df_k \quad (=0) \\ + \sum \{ d_{n-1-k} \{ \Phi(mT + kT + t_s + \frac{T}{2}) - \frac{1}{2} (df_{k+1} + df_k) \}$$



Data-based eq -

$$\mathbb{E}[\{y[n] - d[n] \Phi(mT + t_s)\}^2] = 0 \quad (3)$$



(Signal at cent.
of data)

, t₂} (Signal at
edge trans.)
e(t₁) }
t₂)

$$\mathbb{E} [\gamma_{[n-1/2]}] = 0 \quad -(4)$$

$$(3) \Rightarrow \mathbb{E} \left[\left(\sum d_{n-1-k} \{ \Phi(mT + t_s + kT) - dfe_k \} \right)^2 \right] =$$

$$\Rightarrow dfe_k = \underline{\Phi}(mT + t_s + kT)$$

$$(4) \Rightarrow \mathbb{E} \left[\Phi(mT + t_s - T/2) - (\underline{\Phi}(mT + t_s + T/2) - dfe_{1/2}) \right. \\ \left. + \sum_{k=1}^n d_{n-1-k} \{ \right. \underbrace{\left. \dots \right\}}_{=0} \left. \} \right] = \\ \Rightarrow \underline{\Phi}(mT + t_s - T/2) = \underline{\Phi}(mT + t_s + T/2) - dfe_{1/2}$$

t_s is a common sol. of (5) & (6)

Edge-based eq.

$$\min \mathbb{E} [(\gamma_{[n-1/2]})^2] = 0 \quad - (7)$$

$$\mathbb{E} [\gamma_{[n-1/2]}] = 0 \quad \checkmark$$

$= dfe_k(n)$

$dfe_k(n+1) = dfe_k$

o

- (5)

o

2 (c)

$$J = 2\mu e(d_{n+1-k} + d_{n+k})$$

$$\cdot(n) - \mu \frac{d(e^2)}{d(dte_k)}$$

$$\checkmark E[(y[n-k])^2] = E\left[\left\{\sum_{k=1} d_{n+k} \Phi(mT + t_s + kT + T/2)\right\}^2\right]$$

$$\Rightarrow dfe_k + dfe_{k+1} = 2 (\Phi(mT + t_s + kT + T/2) - \underline{\Phi(t_s)})$$

$$dfe_k = 2 (\Phi(\underbrace{mT + t_s + kT + T/2}_{t_s'}) - \underline{\Phi(t_s)})$$

$$dfe_N = 2 (\Phi(mT + t_s + NT + T/2))$$

$$dfe_1 = 2 (\Phi(t_s' + T + T/2) - \frac{dfe_2}{2})$$

$$= 2 (\Phi(t_s' + T + T/2) - \frac{1}{2} \times 2 (\Phi(t_s' + 2T + T/2))$$

$$= 2 (\Phi(t_s' + T + T/2) - \Phi(t_s' + 2T + T/2)) +$$

$$dfe_1 = 2 \sum_{k=1,3,-} \Phi(t_s' + kT + T/2) - \Phi(t_s' + \cancel{kT} + 3T/2)$$

$\Phi(t_s)$

- . . . 0 . . . - . . .

$$- \left(\frac{dfc_4 + dfc_{\text{min}}}{2} \right) \} \}^2 \]$$

)

$$\left[\frac{dfc_1}{2} \right]$$

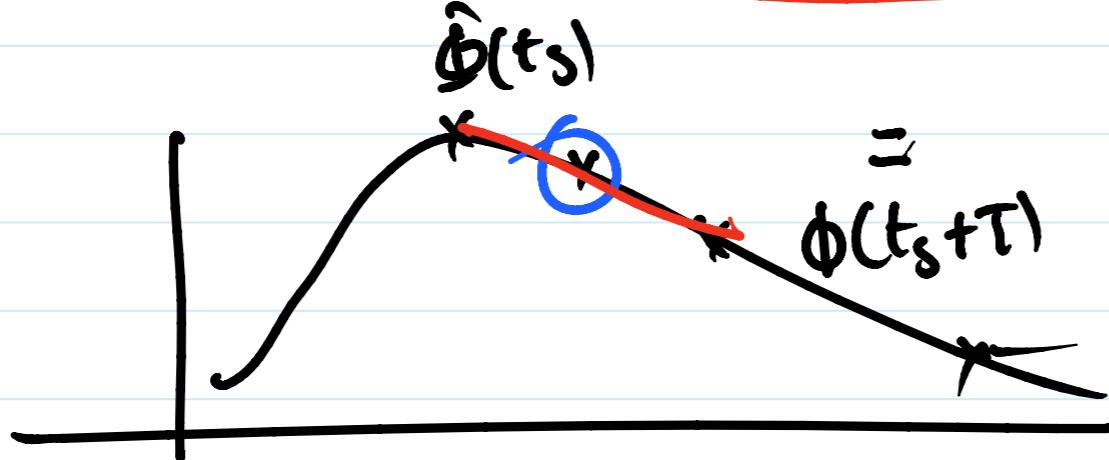
Now last tap

$$r_{l2}) - \frac{dfc_3}{2} \)$$

$$\frac{dfc_3}{2}$$

)

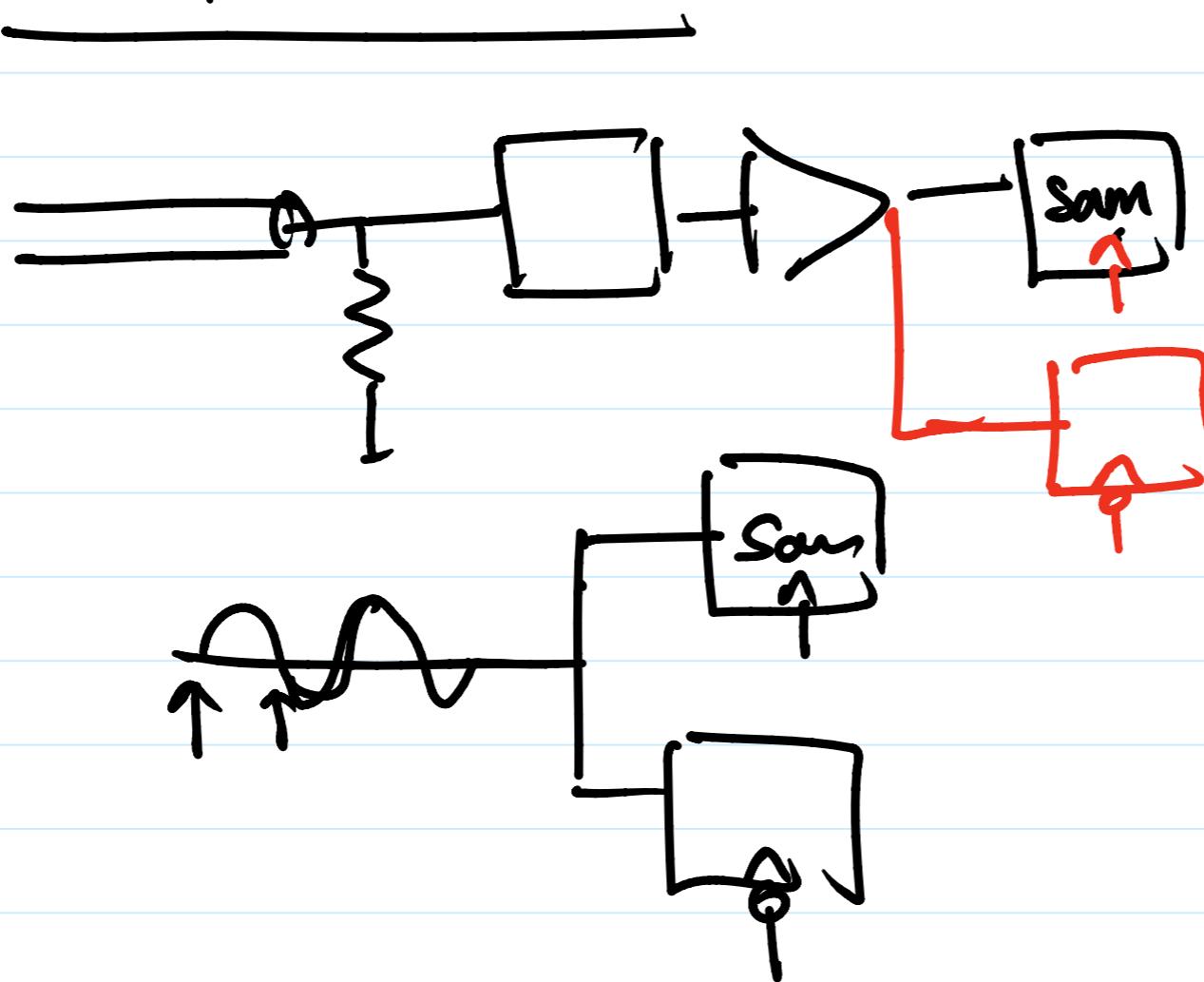
, ,



$$2 \sum \frac{1}{2} \left\{ \hat{\phi}(t_s' + \kappa T) - \hat{\phi}(t_s' + \tau T) \right\} - \frac{1}{2} \left\{ \hat{\phi}(t_s' + \frac{\kappa+1}{2}T) - \hat{\phi}(t_s' + \frac{\kappa}{2}T) \right\}$$

$$dfe_1 = \underline{\hat{\phi}(t_s' + \kappa T)}$$

Samplers in Rx



Samplers

- 1.) i/p amplitude is limited
- 2) Sampler should resolve for bit period
- 3) i/p referred offset
- 4) o/p referred noise

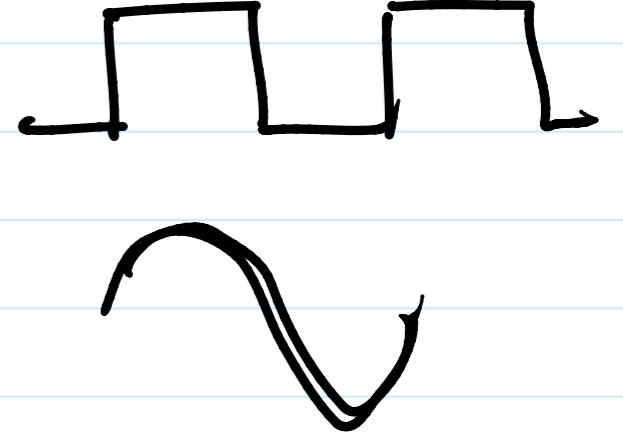
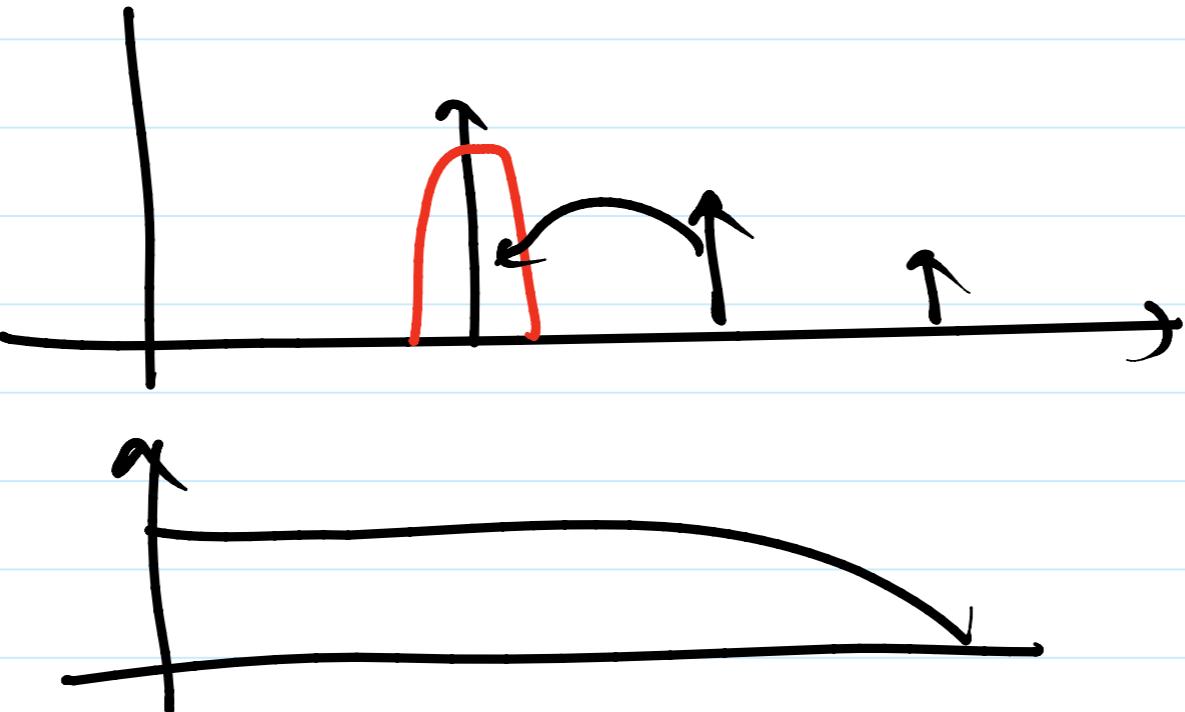
~~$t_s + \sqrt{2}T$~~ }

: $t_s' + \sqrt{2}T$ }



d

or bit 1/0 in one



- 1) CML based sampler
- 2) Sense-amplifier sam
- 3) charge-based samp

✓ high speed
low power

complex — low power

simple — lower power